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PROMOTION TO GS-11 AND GS-12 SOIL
CONSERVATIONIST: SOME EMPIRICAL
ANALYSES OF THE DECISION-MAKING PROCESS

George W. Mayeske

PRS 63-6
October, 1963

PROMOTION TO GS-11 AND GS-12 SOIL CONSERVATIONIST: SOME
EMPIRICAL ANALYSES OF THE DECISION-MAKING PROCESS

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Office of Personnel

United States Department of Agriculture

Washington, D. C.

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SUMMARY AND HIGHLIGHTS

This report presents the results of an analysis of the manner in which information is utilized from the Soil Conservation Service's Appraisal Summary (form SCS-505) in order to determine "Readiness for Promotion" to Soil Conservationist (series 457) GS-11 and GS-12.

The major categories of information on this form are of two types, those referring to an individual's characteristics and those referring to his qualifications.

It was found that there was little or no gain in information after the six most informative categories were considered (see Exhibit 1, page 6). These six categories were: (1) Leadership qualities; (2) Date of last promotion; (3) Potential at two GS levels higher; (4) Technical and scientific proficiency; (5) Organization and; (6) Judgment.

Some assumptions implicit in a Promotion Appraisal plan as well as a means for improving current appraisal procedures through performance documentation are discussed.



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TABLE OF CONTENTS

	<u>Page</u>
Summary and Highlights	ii
Introduction	1
The Utilization of Information in Multiple Regression Analysis	2
Results and Discussion	4
Appendix A - Coding Scheme	10
Appendix B - Computational Rationale and Statistical Summary	14

LIST OF EXHIBITS

	<u>Page</u>
1. Gain in Information by Increasing the Number of Categories	6
2. Squared Multiple Correlation When GS-9 and GS-11 Differences Are and Are Not Taken into Account	15
3. Squared Multiple Correlation When Dependability and Overall Performance Are Included and Excluded	16
4. Squared Multiple Correlation and Raw Score Weights for Each Step in Selecting Categories Which Contribute Most to Estimating Readiness for Promotion to GS-11 and GS-12	17
5. Statistical Summary for GS-9s and GS-11s	18
6. Statistical Summary for Those GS-9s and GS-11s Who Have Categories of Dependability and Overall Performance . .	19

PROMOTION TO GS-11 AND GS-12 SOIL CONSERVATIONIST: SOME
EMPIRICAL ANALYSES OF THE DECISION-MAKING PROCESS

Introduction

The development of a career plan involves the design of a network of choice points and alternative pathways between them. At each choice point there is constructed a set of action determinants--organization policies, personnel needs, laws, regulations, appraisals, judgments, qualification requirements et al--which control or influence whether an individual will pass through the choice point and the path or pathways along which he will travel. Thus, a Soil Conservationist must have certain specified qualifications and experiences in order to be considered as a candidate for promotion from a GS-11 to 12. Then, a process of judgments are applied to select from among the candidates those best fitted to fill the position or positions available. Frequently, qualifications are evaluated and a pool of eligible individuals ascertained before the openings occur. Then, as openings occur they are filled from the pool of eligibles.

Regardless of whether these determinants are explicit and formally stated or are implicit and informal, they function operationally to define the decision-making process that must be performed to select individuals and to meet the requirements of the career system.

Reported here is an analysis of the decision process currently involved in appraising the qualifications of candidates for promotion from GS-9 to GS-11 and from GS-11 to GS-12 in the Soil Conservationist (457) series.

The information used in this analysis was taken from the Soil Conservation Service's Appraisal Summary (form SCS-505) files. Separate files are maintained for GS-9s and GS-11s. A 50 percent sample of each was taken by pulling every other appraisal summary from the file. The information on these forms are of two different kinds: (1) those pertaining to the individual's qualifications (e.g. education, special training, experience) and (2) those pertaining to his characteristics (e.g. leadership qualities, initiative, etc.).

Qualifications data are derived from objective information in personnel folders.

Characteristics data are derived from supervisors' judgments. Periodically, each individual is rated on each of 16 characteristics by two to four (usually three) superiors. At the same time, his raters indicate: (1) whether or not he is considered "Ready for Promotion," (2) what kinds of positions are considered most suitable for him, and (3) an estimate of the grade level for which he has potential to rise in the long run.

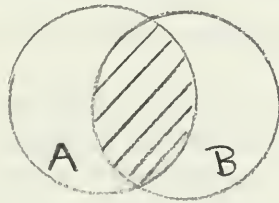
The analysis reported here focuses on the contribution of these qualifications and characteristics categories to an individual's "Readiness for Promotion."

In order to subject information in these categories to a "multiple regression analysis" it was first necessary to quantify the information that appears on these forms. A description of this coding scheme is given in Appendix A.

The Utilization of Information in Multiple Regression Analysis

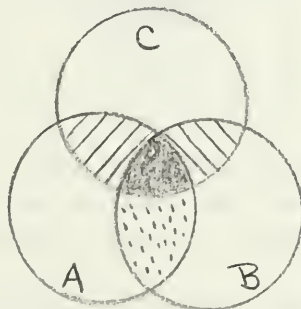
The manner in which this mathematical technique utilizes information is best illustrated by a few simple diagrams.

Suppose that we have two categories of information that are of interest to us. These can be represented by means of two overlapping circles or sets labeled A and B. The area of overlap, the shaded area, represents that information which is common to both A and B.



Suppose we wanted to add up everything in A and B by adding first everything in A and then everything in B. In doing this we would have counted everything in the shaded area twice, once when counting A and once when counting B. In order to be correct in our arithmetic we only want to count the shaded area once, hence we would subtract it once ($A + B = A + B - \text{shaded area}$).

Now let us complicate the picture a little by introducing a third set C,



and let us define the following areas:

- - that information in the intersection of all three sets;
- /// - that information common to B and C which A does not have;
- /// - that information common to A and C which B does not have;

⋄ - that information common to A and B which C does not have.

If we wanted to add up everything in all three sets, $A + B + C$, we would end up counting the dotted and slanted areas twice each and the solid area three times. To correct for this we would subtract the dotted and slanted areas once each and the solid area twice, i.e.

$$A + B + C - \text{dotted} - \text{slanted} - 2 \text{ solid}.$$

We could make the picture increasingly complex by adding more sets of information, however, this example is sufficient. Let us ascribe some meaning to these categories of information.

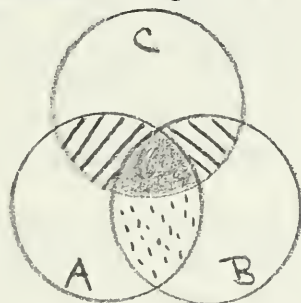
Let us now assume that A, B, and C are three measures on a group of people:

A - Score for each person representing his qualifications;

B - Score for each person representing his characteristics;

C - Score for each person indicating his "Readiness for Promotion."

In this context multiple regression analysis would attempt to ascertain the manner in which categories A and B are combined to arrive at an individual's "Readiness for Promotion" score. The outcome would be a set of weights assigned to each category of information so that when combined they provide the "Readiness for Promotion" score. The weights are assigned to these categories so as to maximize their relationship with the "Readiness for Promotion" score and minimize the amount of overlap between categories A and B. Thus, in the following example:



The solid area would be counted as part of A and then in assigning a weight to B the solid area would not be counted again. Thus, B would play a much smaller part in determining C than would A.

An individual's A score would then be multiplied by the weight for A, his B score by the weight for B, and then these two weighted scores would be summed in order to arrive at an estimated C score. A measure of the adequacy with which the C scores are estimated by this weighting system is called the multiple correlation. This value varies from 1.00 for perfect estimation to .00 for lack of any relationship.

The kinds of questions one seeks to answer from an analysis of this nature are:

1. Are there a few crucial categories of information that contribute most to the overall determination of "Readiness for Promotion?"
2. Do promotion policies need to be made more explicit and administered more consistently?
3. Do the present practices, as they are empirically manifested by the analysis of the current decision-making process, result in the selection of individuals who perform well in the positions to which they are promoted?

Results and Discussion

The results of the statistical analyses accompanied by a computational rationale are given in Appendix B. These relate to a sequence of empirical questions that this analysis sought to answer before ascertaining which were the crucial categories of information.

The first question is: Do supervisors tend to use the same categories of information in the same manner in determining "Readiness for Promotion" to GS-11 as they do in determining "Readiness for Promotion" to GS-12? For all practical purposes, the answer is "Yes." (See Appendix B for detailed analyses.)

The next question deals with the contribution of two characteristics that were added to the appraisal form about 1961--Dependability and Overall Performance. Most individuals in our sample were evaluated on forms that contained these two characteristics. Did these two categories add any information? That is, do we arrive at a different determination of "Readiness for Promotion," when we include the ratings of these characteristics in the analysis than we do when we leave them out?

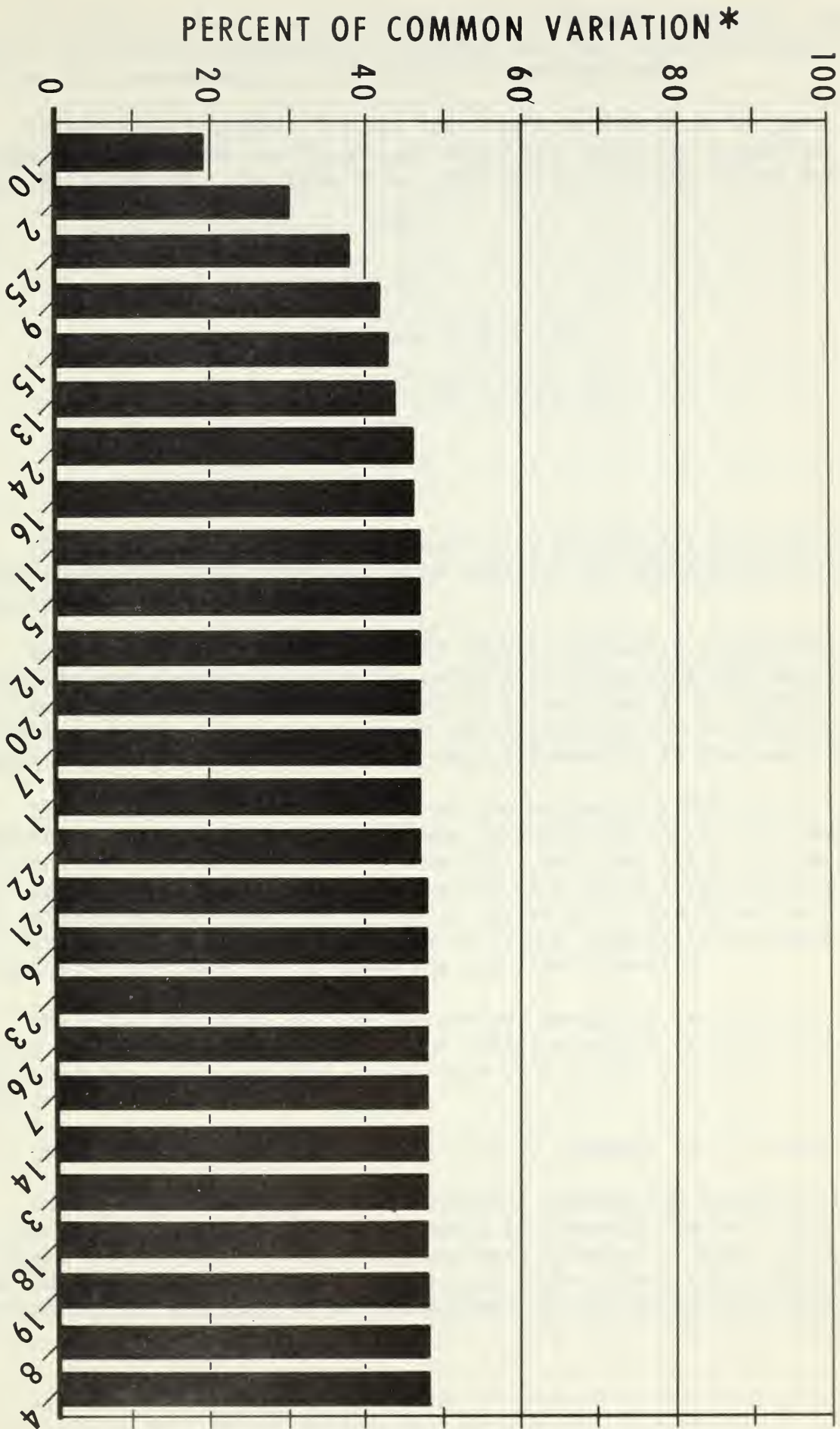
The difference is negligible; therefore we conclude that the categories of Dependability and Overall Performance did not add any new information--did not change the determination of "Readiness for Promotion" that would have been made with the earlier form (see Appendix B).

The analyses up to this point have shown that: (1) the same categories of information are utilized by superiors in the same manner in determining "Readiness for Promotion" for GS-9s and GS-11s and; (2) the addition of the categories of Dependability and Overall Performance did not contribute any new information. One can now focus, for both 9s and 11s combined, on what categories make a crucial contribution to the "Readiness for Promotion" determination. The results are presented in Exhibit 1 and the category titles are listed opposite the exhibit.

Category Titles

1. Date of birth
2. Date of last promotion
3. Number of years of college completed
4. Special training received
5. Number of merit awards within the last five years
6. Number of outstanding performance and/or cash awards within the last five years
7. Number of outstanding performance ratings within the last five years
8. Number of other kinds of awards within the last five years
9. Technical and scientific proficiency
10. Leadership qualities
11. Production
12. Initiative
13. Judgment
14. Decision
15. Organization
16. Adaptability
17. Tact
18. Oral communication
19. Written communication
20. Working with others
21. Supervision
22. Using instructions
23. Breadth of background
24. Number of positions for which the individual has potential at the next highest GS level
25. Number of positions for which the individual has potential at two GS levels higher
26. Number of positions for which the individual has potential at three or more GS levels higher

EXHIBIT 1 GAIN IN INFORMATION BY INCREASING THE NUMBER OF CATEGORIES



MULTIPLE CORRELATION .69.

NUMBER OF CANDIDATES 1,548.

CATEGORY NUMBER ADDED

* THE SQUARED MULTIPLE CORRELATION.

In light of these results we can answer the first question: Are there a few crucial categories of information that contribute most to the overall determination of "Readiness for Promotion?"

Inspection of Exhibit 1 shows that there is little or no gain in estimating "Readiness for Promotion" after the first six categories are taken into account. The rank order contribution of these is as follows:

- 1 Leadership qualities (10)
- 2 Date of last promotion (2)
- 3 Potential at two GS levels higher (25)
- 4 Technical and scientific proficiency (9)
- 5 Organization (15)
- 6 Judgment (13)

The second question to be answered is: Do policies for evaluating these categories need to be made more explicit and administered more consistently?

When the multiple correlation is high it indicates considerable agreement among supervisors in the categories of information they utilize and the weights they give the categories in arriving at a "Readiness for Promotion" score. When the multiple correlation is low it indicates that supervisors do not utilize the available information in the same way.

The multiple correlation shown at the bottom of Exhibit 1 is .69, indicating that agreement among raters is about 49% better than would be obtained by a random assignment of ratings, and that there is room for improvement to be made in the reliability with which supervisors utilize the information in these categories to arrive at a "Readiness for Promotion" score. Some recommendations as to how greater consistency can be achieved are taken up in answering the final question.

The final question is: Do the present practices, as they are manifested by the analysis of the current decision-making process, result in the selection of individuals who perform well in the positions to which they are promoted?

This question can be answered either by judgment or by research.

In the research approach, individuals' information category "scores" on the Promotion Appraisal Summary would be compared against their performance on the jobs to which they had been promoted. Those categories that best predict performance at the next higher level could then be identified. A statement as to the success of the promotion evaluation

plan could then be made. A high relationship between certain of these categories and how well people perform at the next higher level would indicate that the program is successful--that superiors had a high "batting average" in using the information available to predict degree of success of subordinates.

If management is satisfied, at present, with the performance of people being promoted under this system, then the present analysis shows the kinds of information that are critical in making these decisions. However, if improvement in the system is desired, then management might scrutinize at least some of the assumptions implicit in any Promotion Appraisal plan. These assumptions are:

(1) that the supervisor has the opportunity to observe behaviors of his subordinates which are indicative of how well they will perform at the next higher level for which they are being evaluated;

(2) that the supervisor does make these observations and records them; and

(3) that this record is then a basis for the promotion recommendations that the supervisor makes.

To improve the system management would want to:

(a) find out what behaviors are predictive of performance at the next higher level;

(b) insure that supervisors know what behaviors these are; and

(c) insure that these behaviors are observed and recorded as part of the ongoing supervisor--supervisee relationship.

Such a program is currently underway with the Soil Conservation Service in their Critical Incident Survey. This survey involves the collection, from people on the job, of examples of effective and ineffective job behaviors.

In the creation of an operational system the remaining steps involve:

(1) incidents are grouped into a set of logical categories of critical job requirements which are presented in a Performance Record form;

(2) supervisors are trained to observe and then categorize and record these incidents in the Performance Record; and

(3) when an administrative decision, such as a promotion recommendation, is to be made, the supervisor can refer to his documentations in the Performance Record.

One of the bases for a promotion recommendation would be the extent to which the same kinds of critical requirements exist at both the level at which the individual is currently an incumbent and the level for which he is a candidate for promotion. Thus, if an individual manifests effective behaviors in his current position and these same kinds of behaviors are critical requirements at the next higher position, he would be an attractive candidate for promotion.

A P P E N D I X A

SCS Coding for Statistical Analysis of Appraisal Summary GS 457

Promotion eligibility for: 9 to 11, 457 series
 11 to 12, 457 series

1. Date of birth - Use the last three digits of the year of birth, i.e.,
 8__ or 9__.
2. Date of last promotion - Use the last two digits of the year of
 promotion, i.e., __ to __.

3. Education - Years of college completed

High school graduate or less	00
One year college	01
Two years college	02
Three years college	03
Four years (Bachelor's degree perhaps)	04
Five years (Master's degree perhaps)	05
Six years (Master's degree perhaps)	06
Seven years (Ph.D. degree perhaps)	07
Eight years (Ph.D. degree perhaps)	08
Nine years	09 etc.

Count each additional Bachelor's degree as an additional year of college.

Count each additional Master's degree as an additional year of college.

4. Special training - Number of training courses or schools listed
 (00 to __).
5. Number of merit awards, within last 5 years (0 to 9).
6. Number of outstanding performance awards and/or cash awards, within
 last 5 years (0 to 9).
7. Number of outstanding performance ratings, within last 5 years
 (0 to 9).
8. Number of other kinds of awards, within last 5 years (0 to 9).
9. TOS
10. LQ
11. Production
12. Initiative

13. Judgment
14. Decision
15. Organization
16. Adaptability
17. Tact
18. Oral communications
19. Written communications
20. Working with others
21. Supervision
22. Using instructions
23. Dependability
24. Overall performance

To score 9 through 24 assign values of 2 to strong, 1 to average, and 0 to weak. Multiply these by the number of X's in category for each characteristic, add these up and divide by the total number of X's for that characteristic. For example:

	<u>Strong</u>	<u>Average</u>	<u>Weak</u>
	2	1	0
9. Tech. & Scien. Proficiency	X	XX	X
	2	2	$0 = \frac{4}{4} = 1$

This score will range from 0 to 2, i.e., $\frac{0}{4}$ to $\frac{8}{4}$ (multiply each score by 100 and retain the first three numbers).

25. Breadth of background - The total number of positions to which an individual could be reassigned (0 to _).
26. No. of positions for which the individual has potential (0 to _) at the next highest GS level.
27. No. of positions for which the individual has potential (0 to _) at two GS levels higher.

28. No. of positions for which the individual has potential (0 to _) at three or more GS levels higher.
29. Average number of raters recommending promotion to Work Unit Conservationist - Divide the number of X's indicating readiness for promotion to Work Unit Conservationist by the total number of raters.

This score will range from 0 to 1, i.e. $\frac{0}{4}$ to $\frac{4}{4}$ (multiply each score by 100 and retain the first three numbers).

A P P E N D I X B

Computational Rationale for the Sequence of Empirical Questions

A full explanation of the following procedures is given in Bottenberg, R. A., and Ward, J. H., Jr., Applied Multiple Linear Regression, Technical Documentary Report PRL-TOR-63-6, March 1963, 6570th Personnel Research Laboratory, Aerospace Medical Division, Air Force Systems Command, Lackland Air Force Base, Texas.

1. Can the same regression equation be used to predict "Readiness for Promotion" from GS-9 to 11 as from GS-11 to 12? This question is answered by observing the magnitude of the difference between the following two squared multiple correlations (SMC's): (1) the SMC computed on all 26 categories (Overall Performance and Dependability omitted) for both groups combined; (2) the SMC computed on all 26 categories and a 27th category introduced for group membership (scored 1 for a 9 and 0 for an 11). One way to evaluate the magnitude of this difference (given in Exhibit 2) is by reference to the F statistic using the appropriate degrees of freedom (see Bottenberg and Ward, P. 125-126). The differences obtained in this analysis were evaluated against the criterion of loss of predictive power versus ease of using a single regression equation. With this criterion a difference of .04 reported in Exhibit 2 was judged not to be appreciable enough to depart from a single regression equation.

2. Do the categories of Dependability and Overall Performance contribute any information in addition to that in the other categories? This question is answered by observing the magnitude of the difference between the following two SMC's computed on both 9s and 11s who have these two additional categories: (1) the SMC computed when these two categories are excluded from the analysis and; (2) the SMC computed when these two additional categories are included in the analysis. The difference of .01 given in Exhibit 3 is not appreciable enough to consider them as contributing any differential information.

Exhibit 2

Squared Multiple Correlations When GS-9 and GS-11
Differences Are and Are Not Taken into Account

Taken into account	SMC = .52
Not taken into account	SMC = .48
Difference	.04

Exhibit 3

Squared Multiple Correlations When Dependability and
Overall Performance Are Included and Excluded

Included	SMC = .54
Excluded	SMC = .53
Difference	.01

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
	Weights for Addition or Next Best Category on Each Trial																									
Date of birth														-.14	-.16	-.15	-.16	-.15	-.15	-.15	-.14	-.14	-.14	-.14	-.14	-.14
Date of last promotion														-4.02	-3.81	-3.61	-3.71	-3.72	-3.60	-3.70	-3.74	-3.73	-3.78	-3.80	-3.80	-3.66
Education														-3.69	-3.69	-3.69	-3.68	-3.69	-3.69	-3.70	-3.69	-3.70	-3.69	-3.70	-3.70	-3.70
Special training																										
Merit awards														5.41	5.34	5.21	5.11	5.13	5.18	5.24						.07
Outstanding perf. & cash awards																										
Outstanding performance ratings																										
Other awards																										
Technical and scientific prof.																										
Leadership qualities		.40	.41	.33	.21	.18	.14	.15	.15	.14	.13	.11	.10	.13	.13	.13	.13	.12	.12	.12	.12	.12	.12	.12	.12	.12
Production						.26	.20	.17	.17	.15	.13	.11	.10	.10	.09	.09	.09	.09	.09	.10	.09	.09	.09	.09	.09	.09
Initiative										.08	.08	.06	.06	.06	.05	.05	.05	.04	.04	.04	.04	.04	.04	.04	.04	.04
Judgment							.13	.13	.11	.12	.12	.11	.12	.11	.11	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10	.10
Decisions																										
Organization						.15	.13	.14	.13	.10	.10	.09	.09	.09	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08
Adaptability								.10	.10	.10	.09	.07	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08
Tact																										
Oral communications																										
Written communications																										
Working with others												.05	.08	.08	.07	.07	.07	.07	.07	.07	.07	.07	.07	.07	.07	.07
Supervision																.03	.03	.03	.03	.03	.03	.03	.03	.03	.03	.03
Using instructions																.04	.03	.03	.03	.03	.03	.03	.03	.03	.04	.04
Breadth of background																		.72	.71	.71	.71	.74	.73	.78	.76	.76
Potential at next level																										
Potential at two levels			18.59	17.48	16.97	16.23	16.03	15.62	15.37	15.31	15.11	15.20	15.16	15.51	15.50	15.51	15.54	15.27	15.23	15.24	15.23	15.26	15.23	15.24	15.25	15.24
Potential at three or more levels																				2.66	2.41	2.42	2.42	2.42	2.44	2.44
Squared multiple correlation	.19	.30	.38	.42	.43	.44	.46	.46	.47	.47	.47	.47	.47	.47	.47	.48	.48	.48	.48	.48	.48	.48	.48	.48	.48	.48

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28			
Date of birth		.40	.09	.10	.02	.04	.02	-.01	-.02	.13	.07	.27	-.04	-.02	.14	.27	.05	.02	.02	.10	.08	.24	.01	.22	.19	.12	.13	-.06			
Date of last promotion			-.02	.09	-.02	-.01	.06	-.01	-.07	.04	.06	.13	.00	-.02	.05	.11	.06	-.07	.07	.04	.14	-.02	.09	-.04	.04	-.32	-.31				
Education																															
Special training				-.09	-.01	-.02	.00	-.05	.07	-.06	-.04	-.03	-.05	-.03	-.04	.03	-.02	-.03	.01	-.04	-.06	-.02	.10	.08	.08	.03	.00	-.01			
Merit awards					.05	.38	.08	.01	.03	.04	.11	.09	-.02	.01	.10	.04	.01	.11	.06	.00	.05	.04	.08	.09	.06	-.00	-.08	.01			
Outstanding perf. & cash awards							.08	.08	.04	.14	.14	.12	.07	.06	.11	.06	.04	.05	.07	.09	.09	.06	.10	.03	.06	.03	-.08	.13			
Outstanding performance ratings								.08	.12	.17	.20	.17	.08	.09	.13	.10	.05	.11	.08	.09	.13	.10	.09	.09	.05	.03	-.10	.13			
Other awards								-.01	.08	.11	.12	.09	.07	.05	.11	.06	.05	.02	.03	.09	.08	.08	.04	.02	.03	.12	-.05	.07			
Technical and scientific prof.									.06	.03	.04	.06	.01	-.01	.06	.00	.02	.01	.03	.01	.03	.02	.03	-.02	.01	-.01	-.04	.03			
Leadership qualities										.37	.31	.34	.45	.45	.38	.30	.16	.27	.30	.20	.40	.41	.23	.13	.19	.18	-.18	.39			
Production											.43	.58	.47	.53	.53	.49	.47	.40	.25	.47	.60	.37	.19	.10	.29	.12	-.28	.44			
Initiative												.54	.26	.35	.51	.29	.16	.18	.24	.48	.39	.16	.06	.20	.10	-.20	.32				
Judgment												.25	.38	.38	.50	.42	.15	.29	.24	.28	.46	.40	.15	.14	.24	.12	-.20	.33			
Decisions													.66		.43	.40	.43	.46	.25	.26	.46	.47	.46	.18	.09	.26	.08	-.15			
Organization														.45	.43	.41	.29	.33	.28	.36	.52	.43	.18	.10	.24	.07	-.19	.39			
Adaptability																.37	.22	.30	.27	.26	.62	.50	.15	.11	.22	.09	-.22	.38			
Tact																	.47	.27	.17	.52	.40	.45	.16	.13	.23	.10	-.13	.33			
Oral communications																	.19	.27	.17	.52	.40	.45	.16	.13	.23	.10	-.13	.33			
Written communications																		.19	.27	.17	.52	.40	.45	.16	.13	.23	.10	-.13	.33		
Working with others																		.19	.27	.17	.52	.40	.45	.16	.13	.23	.10	-.13	.33		
Supervision																			.19	.27	.17	.52	.40	.45	.16	.13	.23	.10	-.13	.33	
Using instructions																			.19	.27	.17	.52	.40	.45	.16	.13	.23	.10	-.13	.33	
Breadth of background																				.19	.27	.17	.52	.40	.45	.16	.13	.23	.10	-.13	.33
Potential at next level																				.19	.27	.17	.52	.40	.45	.16	.13	.23	.10	-.13	.33
Potential at two levels																				.19	.27	.17	.52	.40	.45	.16	.13	.23	.10	-.13	.33
Potential at three or more levels																				.19	.27	.17	.52	.40	.45	.16	.13	.23	.10	-.13	.33
GS level (9=1) (11=0)																				.19	.27	.17	.52	.40	.45	.16	.13	.23	.10	-.13	.33
Readiness for promotion																				.19	.27	.17	.52	.40	.45	.16	.13	.23	.10	-.13	.33
Mean		1917.26	57.92	3.94	1.14	.10	.27	.02	.04	142.67	132.52	128.34	144.86	140.53	134.35	127.81	141.21	145.55	129.32	119.06	158.09	122.45	136.14	.54	1.13	.31	.02	.68	36.27		
Standard Deviation		8.43	2.97	.73	1.24	.33	.56	.14	.21	36.17	39.88	38.92	40.19	36.19	33.95	37.84	34.34	39.28	33.44	28.58	37.15	34.94	36.13	.81	.84	.60	.16	.46	36.48		
n=1548																															

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